Geology, Geophysics & Environment 2016, vol. 42 (1): 124–125

$\delta^{13}C$ variation in carbonate platform sediments of the Northern Tethys in Late Jurassic

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Carbon isotopic composition of Late Jurassic sediments displays a trend of ^{13}C depletion in the World ocean. Meanwhile, depending on local paleogeographical conditions, $\delta^{13}C$ curves for different palaeoprovinces differ in inclinations and absolute values (Nunn & Price 2010). That is why a separate $\delta^{13}C$ curve needs to be developed for every specific region. After such development, the inverse problem – correlation of the sedimentary complex by comparing $\delta^{13}C$ parameters – can be solved. A comparison of $\delta^{13}C$ values in contemporaneous sediments can be also used as an instrument for testing paleogeographical and paleoecological models.

Previous $\delta^{13}C$ data for the Upper Jurassic sediments of the Tethys region were obtained for its Western passive margin and Central Atlantics (Padden et al. 2002, Coimbra et al. 2009). These data have been acquired from precisely dated hemipelagic sediments containing index fauna and epioceanic Ammonitico-Rosso facies. In the current study we present $\delta^{13}C$ variations in carbonate platform sediments from the backarc basin of the Northern Tethys (N20° to N40°) (Meijers et al. 2010) mostly based on Sr-chemostratigraphic correlation and dating of carbonate complexes.

We studied Sr, C and O isotopic composition of the Upper Jurassic carbonate complexes of the Crimean Mountains. These complexes were formed under different conditions: Kimmeridgian and Early Tithonian sediments were deposited in shallow-water carbonate platform settings. In most cases they lack index fossils and their age is defined by Sr-chemostratigraphy (Rudko et al. 2014); Late Tithonian to Early Berriasian sediments were sampled from a carbonate platform reef facies, slope and toe of slope carbonate megabreccias. Reef and breccias deposits were dated using Sr-chemostratigraphy, and confirmed by calpionellide biostratigraphy.

In the absence of well preserved faunal remnants in the studied sections, limestone samples with the best preservation of primary sedimentary textures were collected for Sr isotopic–geochemical studies. Samples with large calcite veins or abundant epigenetic sparite were excluded from this research. Limestone samples for reconstructing the $^{87}Sr/^{86}Sr$ isotopic parameters of depositional environments were selected using geochemical criteria ($Mn/Sr < 0.2$, $Fe/Sr < 1.6$, $Mg/Ca < 0.024$; $\delta^{18}O > -1.5‰$) and subjected to preliminary treatment in a 1 N ammonium acetate solution. From more then 100 analyzed samples only 13 best preserved were used to provide correlation between sections and the age of strata.

Most of samples used to determine C isotopic composition are represented by micritic limestones with low content of sparry cements and fragments of primary aragonitic grains. The content of insoluble impurities in limestones does not exceed 9%. All selected samples display no correlation between the amount of siliciclastic impurities, $\delta^{13}C$ and $\delta^{18}O$ values. $\delta^{13}C$ values in the measured samples vary between +1 and 3.5‰, $\delta^{18}O$:

http://dx.doi.org/10.7494/geol.2016.42.1.124 ISSN 299-8004 | e-ISSN 2353-0790 | Wydawnictwa AGH

from –2.9‰ to +1,3‰. C – isotopic composition in 44 samples was considered to be diagenetically unaffected and they were selected to provide $\delta^{13}C$ curve. According to the results of comparison of stable isotope composition with microfacies of samples, $\delta^{13}C$ values are not environment-dependent in contrast to $\delta^{18}O$, which are slightly enriched in ^{18}O in offshore and slope facies.

The measured values of $\delta^{13}C$ are falling from an average 3.2‰ in Late Kimmeridgian through 2.6‰ in Early Tithonian to 1.7‰ in Late Tithonian – Early Berriasian. This corresponds to the global $\delta^{13}C$ trend in Upper Jurassic sediments (Nunn & Price 2010). Among other Kimmeridgian – Berriasian carbonates the Northern Tethys carbonate platform deposits are 0.5–1‰ higher than $\delta^{13}C$ from the Western Tethys (Coimbra et al. 2009).

The following factors (or their combinations) may explain observed ^{13}C-enriched isotopic composition of the Northern Tethyan backarc basin deposits: 1. increased amount of shallow-water allochems and cements in the sediments of carbonate platform and its aprons, compared to hemipelagites of Western Tethyan margin; 2. increased bioproductivity of photosynthetic organisms – cyanobacteria and green algae that played an important role in the studied Upper Jurassic carbonate platform deposits (Krajewski 2010, Piskunov et al. 2012, Bucur et al. 2014), removed large quantity of light carbon from water, leading to ^{13}C enrichment of bicarbonate. It is interesting to note that volcanic activity on Tethyan active margin seems not to have an impact on $\delta^{13}C$ values of the studied sediments.

The research was supported by RFBR grant 15-05--08767.

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